

Investigation of Acute Gastroenteritis at a Popular Resort Area

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THE MILD "enteric disorders" so common in the summer and fall are among the most common and yet the most ill-defined groups of illnesses afflicting the American people. These diseases sweep communities, States, and entire sections of the Nation. Largely because of ignorance of their etiologies, they are known among laymen and physicians alike as "the flu" or "intestinal flu" or "acute gastroenteritis."

As better methods of medical, epidemiologic, and laboratory investigation have become available, many summer diarrheas have been proved to be caused by *Salmonella*, *Shigella*, and other bacteria. Only a small percentage are treated by physicians, and when treatment is instituted, it is symptomatic. However, physicians consider the etiology of most enteric disorders as unknown, probably viral. Their mode of transmission is also unknown, possibly person to person. Practicing physicians consider them to be self-limited, of short duration, and of mild nature. Perhaps, from a practical clinical viewpoint, that is all one needs to know.

Nevertheless, no human ailment, however mild, should be ignored. It is only through the study of a disease from the subclinical through the fatal stage that we come to understand its true biology and epidemiology and that we learn effectively to prevent or control its occurrence. For example, how is a mild case of gastroenteritis in John related to aseptic meningitis in Jimmy next door? This riddle is what

fascinates the epidemiologist. Yet, hampered by difficulties in case reporting, he is usually unable to make adequate studies.

Occasionally an outbreak of illness occurs which is so explosive and in which the cases are so closely associated that definitive epidemiologic study is possible. Such an outbreak occurred in the Seattle area in the summer of 1959. However, the numbers in the incident were small and laboratory diagnosis was limited. The following report may serve to place another piece in the jigsaw puzzle of "nonspecific enteric disease."

Background

On July 22, 1959, the Seattle-King County Department of Public Health was notified of the occurrence of acute gastroenteritis in 7 of 12 members of one family after a company picnic on July 18 at a well-known resort. The picnic was a potluck affair, with each family bringing food. Ice cream and soda pop were supplied by the company. The reporting family felt that other members of the party might also have become ill. Subsequent investigation revealed illness in at least three other company employees.

Six days later, on July 28, a mother reported gastrointestinal illness in 29 of 36 members of an exclusive girls' club following a weekend outing at the same resort, from Friday evening, July 24, to Sunday morning, July 26. The illness was so explosive and severe that the group's entire recreational program was abandoned. The girls stated that they had purchased food in Seattle and prepared it at the resort. Many

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of them complained that the water at the resort tasted bad and had a foul odor.

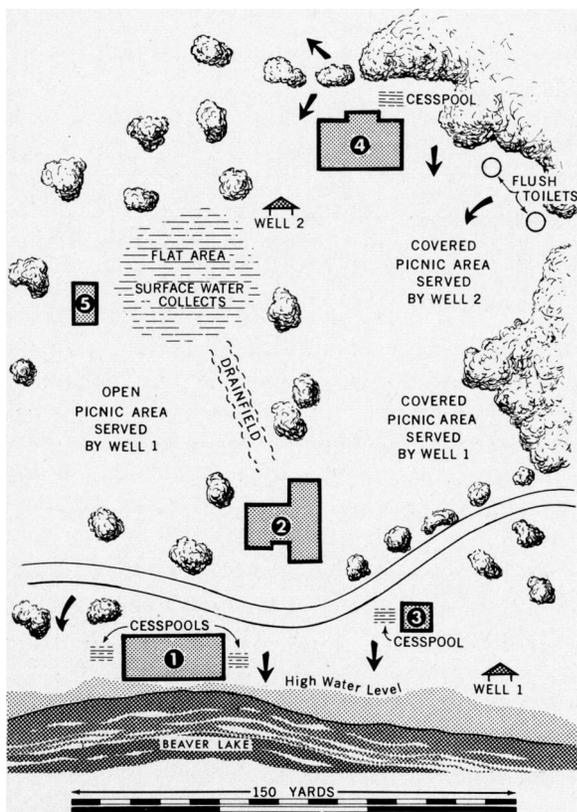
The epidemiology and sanitation divisions of the health department launched an immediate investigation.

Method of Investigation

A roster of the persons attending the outings and a complete menu of all foods consumed were obtained from both the girls' club and the company picnic group. Epidemiologic histories of members of both groups were obtained by telephone.

Health department personnel visited the resort on July 28 and 29. A list of all organizations using the area between July 18 and 26 was obtained from the owner. Information re-

Plan of King County, Wash., resort area at which an outbreak of gastroenteritis occurred in July 1959



(1) OWNER'S RESIDENCE AND HALL; (2) STORE AND DANCE HALL; (3) CARETAKER'S CABIN; (4) LODGE SERVED BY WELL 2; (5) SHOP. BOLD ARROWS INDICATE DIRECTION OF SURFACE AND SUBSURFACE DRAINAGE.

garding illness, activities, and resort facilities used was obtained from the social chairman of each organization by telephone.

A sanitary survey of the resort area was also made. Stool specimens were requested from all girls reporting diarrhea. Four specimens were obtained. Water samples were obtained from the two water supplies on the premises and from the lake on which the swimming beach is located.

Findings

The resort is about 20 miles from Seattle, in a wooded area between two lakes. It is open the year round, but the period of greatest activity is summer. It caters to group picnics in addition to providing overnight cabin and dormitory facilities to organizations and vacationing families.

Facilities at the resort include 14 cabins, a clubhouse and lodge, a dance hall and store, a headquarters building and owner's residence, outside restrooms, a boathouse, 6 outside kitchens, a caretaker's cabin, a workshop, 2 covered picnic areas, outdoor tables, and a swimming beach. A diagram of the area surrounding well 2 is provided in the figure.

The water supply is from two shallow wells. Well 1, located about 20 feet from the swimming beach, serves about 90 percent of the area and is the principal source of water for the resort. This well is 16 feet deep and has a concrete casing and an electric pump. It was checked by the sanitation division of the health department on July 22, 1959, during a routine inspection of the resort. At that time, the location and construction of the well were judged satisfactory. The water, however, was listed as not conforming to drinking water standards, since it had consistently tested positive for coliform organisms in the past.

Well 2, located approximately 200 yards uphill and southwest of well 1, serves an outdoor kitchen, a covered picnic area, and a clubhouse with overnight lodge-type accommodations. This well is 24 feet deep and is enclosed in a concrete casing. It has a piston-type pump with a pressure tank. The well covering is made of loose boards which allow easy contamination of the water by surface drainage. At

the time of inspection debris was floating on the surface of the water. Until July 22, this well had never been inspected by the health department; in fact the department was unaware of its existence.

Water samples were taken from both wells on July 28 and 29. Both samples contained coliform organisms, ranging from 5 to 240 MPN.

The resort provides no food except bottled cold drinks, packaged candy, confections, and frozen ice cream bars. The common practice is for groups to bring their own food, which has either been previously prepared at home or is prepared at the resort, using resort facilities. Questioning revealed that very few members of either the company picnic group or the girls' club purchased confections at the resort. Sanitary inspection of the confectionery counter revealed satisfactory storage and refrigeration of the items sold.

The resort has modern restroom facilities with flush toilets. Sewage is disposed of through cesspools. Periodically, the cesspools are pumped by the resort owner and the sludge is buried approximately one-half mile from the resort in a heavily wooded area.

Dye was flushed into several toilets on the second day of the investigation but no dye was recovered in either of the two wells.

Thirty-five of the 36 persons at the girls' club outing were interviewed. Twenty-nine gave a history of illness, beginning from 12 to 48 hours following arrival at the resort and lasting from 6 to 48 hours. Table 1 shows the symptoms suffered.

The resort water supply was, of course, highly

Table 1. Symptoms of illness among 29 persons at a resort in King County, Wash.

Symptom	Persons reporting symptom	
	Number	Percent
Nausea.....	26	90
Vomiting.....	20	69
Abdominal cramps.....	13	45
Fever.....	13	45
Diarrhea.....	10	34
Headache.....	6	21
Dizziness.....	3	10

Table 2. Comparison of incidence of illness with source of water in groups using a popular resort in King County, Wash., July 18-26, 1959

Group code No. ¹	Total persons using water	Source of water (well No.) ²	Persons ill	
			Number	Percent
18-1-----	100	1	0	0
18-2-----	75	1	0	0
18-3-----	80	1	0	0
18-4-----	75	1	0	0
18-5-----	150	2	10	7
19-1-----	400	1	0	0
19-2-----	150	1	0	0
19-3-----	60	2	0	0
19-4-----	40	2	0	0
19-5-----	50	Unknown	0	0
19-6-----	100	Unknown	0	0
19-7-----	50	1	0	0
19-8-----	45	1	0	0
22-1-----	1,000	1, 2	0	0
24-1-----	36	2	29	80
25-1-----	83	2	12	14
25-2-----	125	1	2	2
25-3-----	100	1	0	0
25-4-----	30	1	0	0
26-1-----	150	2	7	5
26-2-----	125	1	0	0
26-3-----	125	1	0	0
26-4-----	40	1	0	0
26-5-----	40	1	0	0
26-6-----	100	1	0	0
26-7-----	80	1	0	0
26-8-----	100	1	0	0
26-9-----	40	1	0	0

¹ First two figures indicate day of month; last figure, number of groups using water source on that day.

² Based on area used for food preparation and serving and on source of water available to that area.

suspect because of well construction, positive coliform counts, and reported bad odor and taste of the water. A comparison between use of water and incidence of illness was made for all groups using the resort during the 9-day period July 18-26. The results are presented in table 2.

Many groups visiting the resort bring their own beverages so that a large percentage probably do not drink resort tapwater, particularly if they are there only a few hours. However, because the girls' club, code No. 24-1, stayed at the resort for several days and because such a high percentage of this group became ill, a rather intensive investigation was made of their food and water consumption and of the swimming activities of the group. Of 22 who swam in the lake, 18, or 82 percent, became ill. Of the 10 who did not swim, 8, or 80 percent, became

ill. Swimming histories were not available on 4 of the 36 girls. Table 3 presents data on the food and water consumption of this group.

Etiological Agent

Bacterial examination of stool specimens from four members of the girls' club who suffered diarrheal symptoms were done by the laboratory division of the Seattle-King County Department of Public Health. The specimens were negative for *Salmonella*, *Shigella*, and pathogenic coliform organisms. The stool specimens were frozen and held for virus isolation. ECHO 9 virus was grown on tissue culture from two specimens. Typing of the virus was done by neutralization tests.

Control Measures

Results of the investigation of the resort area indicated that water, particularly water from well 2, was highly suspect as the vehicle of transmission in the gastrointestinal outbreaks. The following recommendations were made:

- Immediate cessation of use of well 2 as a water source.
- Flushing of all plumbing with hypochlorite solution.

- Adequate chlorination of all water used at the resort area.
- Rebuilding of well 2 to meet State requirements for construction of such a well, or abandonment and sealing of this well.
- Frequent inspection of the premises and sampling of the water by a member of the health department sanitation staff to insure that the above measures are properly carried out and that all water at the resort is safe and potable.

Well 2 was abandoned and sealed. The other recommended measures were carried out, and there have been no further reports of disease associated with this resort.

Discussion

From the standpoint of environmental sanitation practices, this popular resort had been courting trouble for a number of years. Fecal contamination of the main well had been demonstrated repeatedly by positive coliform counts. Poor construction and exposure to surface drainage of the auxiliary well certainly left it highly susceptible to surface pollution. Failure to recover dye from either well, although it does not rule out the role of subsurface pollution in contamination of water supplies, does make such pollution a matter of speculation.

Table 3. Correlation of food and water consumption or activity with gastrointestinal illness among 36 persons following use of facilities at a King County, Wash., resort

Food or activity	Number partaking ²	Number ill	Percent ill	Number not partaking ²	Number ill	Percent ill
Swimming	22	18	82	10	8	80
Water (well 1)	4	2	50	27	24	90
Water (well 2) ¹	30	26	87	5	0	0
Macaroni and cheese	22	18	82	9	8	90
Salad	21	18	85	10	8	90
Milk	22	18	82	9	8	90
Coffee	4	3	75	27	24	89
French toast	30	25	83	2	2	100
Cantaloupe	31	26	84	1	1	100
Coffee	9	4	44	24	20	83
Hot dog	28	23	82	4	3	75
Cocoa	22	19	86	3	3	100
Potato salad	28	24	86	4	3	75
Pork and beans	23	19	83	9	7	78
Fruit salad	25	19	76	7	6	86
Casserole	31	26	84	1	1	100
Buns	25	19	76	6	6	100
Milk	24	20	83	5	5	100
Coffee	6	5	83	25	21	84
Ice cream, concession	0	0	0	28	23	82
Soda pop, concession	12	10	83	18	14	77

¹ Includes soft drink made from water from well 2.

² Includes only those from which a definite history was obtained; unknowns are not included.

The data in table 2 are interesting; note the clustering of illness in groups which followed the large group (22-1) visiting the area on July 22. The resort owner reported overloading of toilet facilities on that date and contamination of the surrounding grounds during the day. From this, one might infer that if pollution of ground water supplies did take place, such pollution might well have occurred during or shortly after this large group had visited the area.

Table 3 shows that almost all the members of the girls' club drank water from well 2. Of those who drank this water, 87 percent became ill. There was also a high percentage of illness in individuals partaking of several other foods and participating in swimming. However, these exposures can be considered coincidental and unrelated when it is demonstrated that a high percentage of illness also occurred in individuals not partaking of these foods or participating in activities. Therefore, it is reasonable to infer from these data that water from well 2 was the vehicle of disease transmission.

Determination of the true etiological agent in these illnesses cannot be made at this time. ECHO 9 (1-3) virus was isolated from two of the four stool specimens submitted. This is a much higher incidence of the ECHO 9 organisms than is usually found in groups of specimens tested for the virus in the laboratory of the Seattle-King County Health Department. According to studies by Ramos-Alvarez and Sabin (4), less than 0.2 percent of healthy persons in this age group should show ECHO 9 virus in their stools. However, lack of further evidence, such as virus in the well water and blood studies for virus antibody titer, and the small size of the sample prevent us from assuming a definite etiological relationship between the ECHO 9 virus and the illnesses.

Particular attention should be directed to the explosive nature of the outbreak. In all

members of the group studied, illness occurred within 48 hours of exposure. Such a sharp incidence certainly points to a common-source type of epidemic and rules out spread by person-to-person contact. The short incubation period might also imply poisoning. However, this can be ruled out by the fact that, in several of the families, well-documented secondary cases occurred following the girls' return home.

Summary

An outbreak of acute gastroenteritis occurred in at least 58 individuals who had visited a resort area near Seattle, Wash., during 1 week in late July 1959. The illness particularly affected two groups who had used certain common facilities at the resort. Epidemiologic study revealed water from a dug well to be the probable vehicle of transmission of the infective organisms. Stool specimens were collected from four members of one group who became ill and were examined for pathogenic organisms. Two of the four specimens contained ECHO 9 virus. No further illness associated with the use of the resort has been reported since chlorination of the water supply was instituted and the suspected well was abandoned as a source of water.

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